



INSTRUCTION MANUAL

AEROTRON UNITRACER MODEL 6P1



VHF-FM
PAGING RECEIVER
Tone & Voice
150 - 174 MHz

INSTRUCTION MANUAL

AEROTRON UNITRACER - MODEL 6P1

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AEROTRON, INC. U.S. HIGHWAY 1, NORTH, P.O. BOX 6527
RALEIGH, NORTH CAROLINA 27608

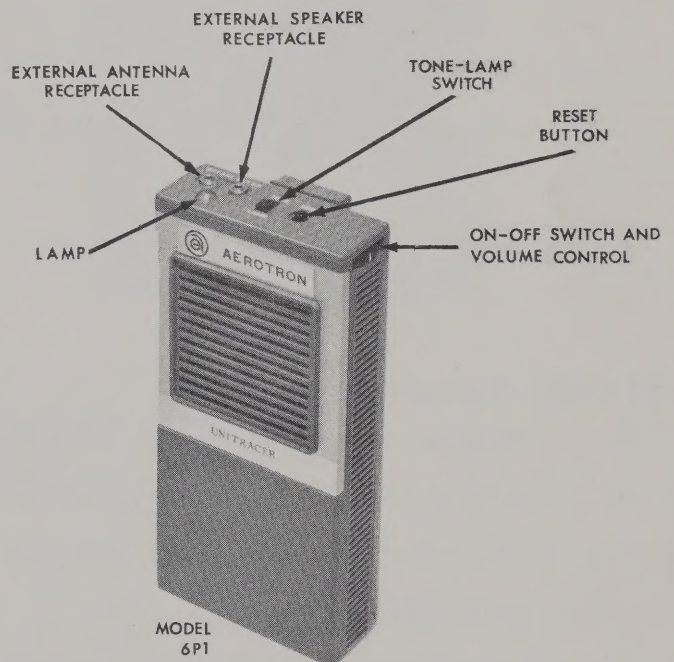
UNITRACER

General Information

The AEROTRON "UNITRACER" voice and tone pager is a completely transistorized, dual conversion, highly selective, FM receiver operating in the 150 to 174 MHz frequency range, for use in selective radio paging systems. An alerting tone followed by a voice message is audible from the unit when it is activated by an on-frequency tone coded carrier signal. The pager will stay activated (unsquelched) for approximately 3 to 4 minutes after a signal is received or it may be immediately deactivated (squelched) by the reset button.

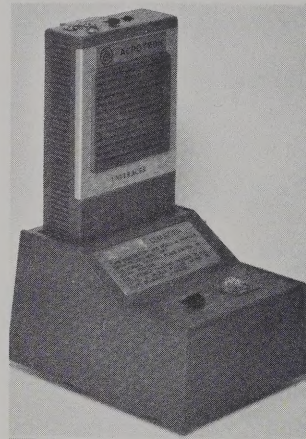
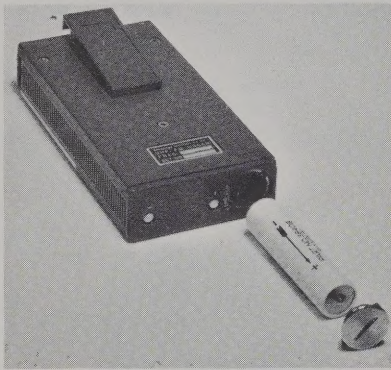
The Unitracer may be used as a part of an AEROTRON selective radio paging system or other similar systems. Selective tone reeds allow the receiver to respond only upon reception of two predetermined sequential tones.

The OFF-ON switch and VOLUME control is located on the upper right hand side of the unit. Receptacle jacks mounted on top of the Unitracer allow it to be used with an external antenna and an external speaker or earpiece and each receptacle jack is clearly identified. When a speaker or earpiece is connected to the pager the built-in speaker is disconnected. A switch to select either tone or lamp alerting is also located on top of the pager.



PREOPERATIONAL NOTES

Remove the Unitracer from the shipping carton and inspect for possible damage. The pager is normally used with a rechargeable Sonotone #38408 nickel cadmium battery. Install the battery in the pager for charging by removing the battery retaining cap and placing the battery in the battery holder with the positive end out. The battery is shipped uncharged and should be charged for 16 hours by placing the pager in the charger (use only the charger supplied by AEROTRON). A Mallory TR-134R, 5.4 volts, mercury battery may be substituted for the nickel cadmium battery if the rechargeable feature is not desired. Test the pager for proper operation in the system. Carefully read the operation instructions.



OPERATION INSTRUCTIONS

1. Plug in external antenna or speaker if desired.
2. Set "lamp-tone" switch to desired position.
3. Turn volume control to right until tone alert or lamp is activated. (Lamp or tone alert will be activated momentarily.)
4. Adjust the volume control for desired receiving level, while listening to a voice message. This control does not affect the tone level or lamp brightness.
5. Depress the reset button following a voice message to return the unit to stand-by (squelled).
6. To turn the unit off, turn VOLUME control fully counterclockwise until a click is heard.
7. Place pager in charger for recharging after use.

ALIGNMENT AND TEST SPECIFICATIONS

APPLICATION

These specifications cover the alignment and bench test of the FM Pocket Pager - 6P1.

REQUIRED POWER SUPPLY

The power supply voltage for the alignment and test procedure should be supplied from a regulated DC source of five (5) volts, $\pm 5\%$. The power supply should be capable of supplying a continuous current of 1 ampere with a ripple voltage of less than 50 millivolts (p-p).

NOTE

Although the current drain of the 6P1 pager only reaches a maximum of 100 mA, the one ampere capability assures that the power supply impedance will be similar to that of the recommended batteries.

REQUIRED TEST EQUIPMENT

The required test equipment for adjustment is specified below. The equipment should be of known accuracy and classification even if they are not particularly specified in this manual.

1. Signal Generator - 10 to 200 MHz range, 0.1 microvolts to 1 millivolt (low leakage required)
2. Frequency Counter
3. 455 kHz, slow sweep rate generator with adjustable output
4. 455 kHz crystal oscillator with adjustable output
5. Oscilloscope with AC and DC input
6. Audio oscillator with calibrated output
7. VTVM with AC scales
8. Audio wattmeter
9. Distortion Meter
10. Encoder
11. Test Reeds

PREOPERATIONAL CHECKS

The following items should be verified prior to adjustment:

- (a) Measure the resistance between the power source input on the circuit board and ground with a VOM (x1 ohm range). The measured value should be more than 23 ohms.
- (b) Power switch ON and operation confirmation - Measure the current by connecting an ammeter between the power source terminal and the power input terminal on the circuit board. The current measured should be approximately 10 mA with VOLUME control set at minimum. Turn the power off immediately, if the measured value exceeds 10 mA, and localize the trouble.

AUDIO AMPLIFIERS

Connect the set and test equipment as shown in Figure 1. Check the output waveform on the CRT oscilloscope. The waveform should be a sinewave and symmetrical with respect to the horizontal axis. Set the VOLUME control at maximum. Increase the input voltage from the audio oscillator to 35 millivolts and measure the output distortion. The distortion should be no more than 10% at an output level of 3 V peak to peak as measured on the scope or 2.1 volts as measured on the AC voltmeter.

NOTE

Remove the strap wire connected to drain (D) of FET Q23 during the test, and insert test leads.

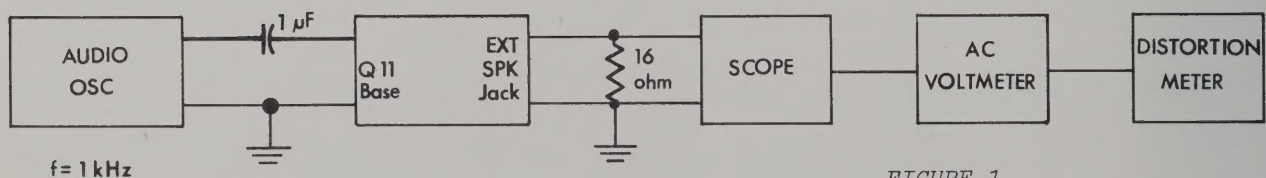


FIGURE 1

REED SELECTOR STAGES

Since the selector circuit is comprised of two circuits, the operation of the "A" circuit should be checked first. After normal operation of the "A" circuit is confirmed, proceed with the check of the "B" circuit.

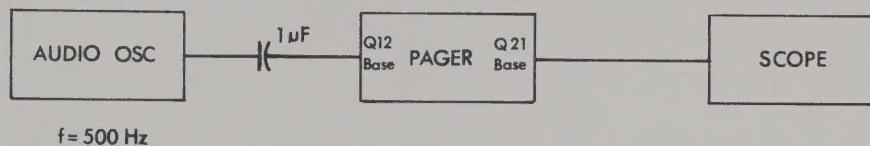


FIGURE 2

- (a) Connect the set and test equipment as shown in Figure 2. After setting the audio input voltage to 8 millivolts, quickly cut off the input. An output voltage drop accompanied by a time delay of approximately 0.7 second shown in Figure 3 should be displayed on the CRT oscilloscope.

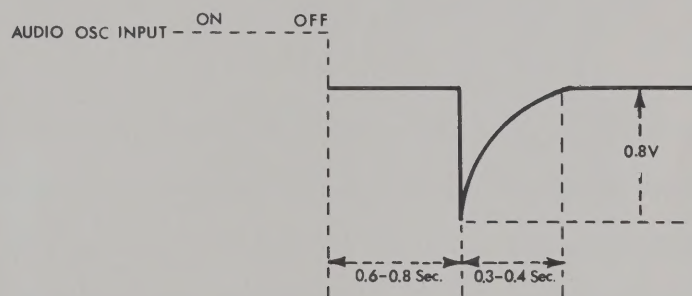


FIGURE 3

Confirm, with the use of a CRT oscilloscope, that the collector voltage of transistor Q17 varies as shown in Figure 4, during the sequence just outlined.

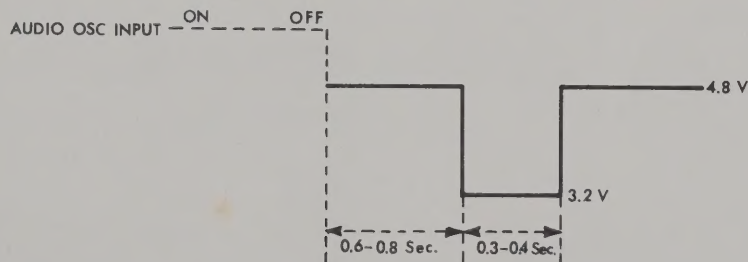


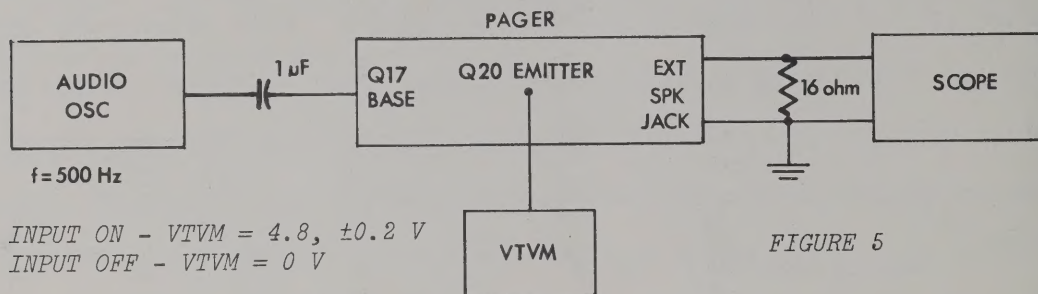
FIGURE 4

- (b) Connect the pager and the test equipment as shown in Figure 5, and set the output voltage of the audio oscillator to 8 mV. Observe VTVM readings as indicated in Figure 5.

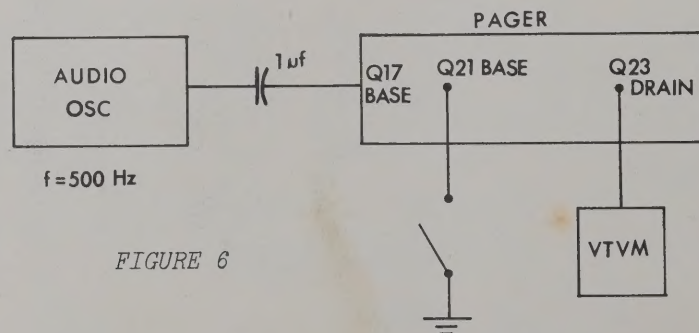
NOTE

Remove the strap wire from Q21 collector, and set switch S3 to the TONE position.

A sinewave of approximately 2.5 kHz (generated by tone alert osc.) should be observed on the CRT, and the output waveform may be clipped at the top and bottom.



After the previous operation is confirmed, reconnect the strap wire from transistor, Q21, and set equipment as shown in Figure 6. When feeding a signal to the input, momentarily ground the base of transistor Q21. A call signal should be heard from the loudspeaker. Also, the pilot lamp should light if the switch S3 is turned to the LAMP position. Indication of the voltmeter should maintain the following value for more than three minutes: VTVM = 1.9 to 2.4 volts (the value of the VTVM should drop to zero, when the RESET button is pressed).



TO

SENTRY MANUFACTURING CO.

CRYSTAL PARK

CHICKASHA, OKLAHOMA 73018

SUBJECT: OUR P.O. 11102-3 DATED NOV. 10, 1972

FROM

HILLEBRAND ELECTRONICS

Wired Music Service WMHE-FM

4665 West Bancroft Street

Toledo, Ohio 43615 Phone 531-1681

FOLD HERE

DATE

6-26-73

MESSAGE

DEAR SIR: WE HAD ORDERED 2 RECEIVE CRYSTALS FOR USE IN
 A AEROTRON 6P2 UNITRACER TO OPERATE ON 154.115 MHz, THE
 CRYSTALS WE RECEIVED WILL NOT WORK AS THEY ARE ON WRONG
 FREQUENCY. SHOULD BE - f_c MINUS 455 KHZ $\div 9$ OR

154.115 MHz.

- .445

153.66 $\div 9 = 17.073333$ PLEASE SEND RIGHT CRYSTALS WE WILL RETURN
 WRONG ONES

SIGNED

W. McCray

DATE

REPLY

SIGNED

LETTER-LIMINATOR

ADJUSTMENT OF 455 kHz DISCRIMINATOR (T10,T11)

A DC voltmeter and 455 kHz crystal controlled oscillator are employed to adjust this circuit. The purpose of the adjustment is to set the center frequency to 455 kHz and to obtain a maximum audio output voltage with minimum distortion. Connect the equipment as shown below in Figure 7 for the DC method.

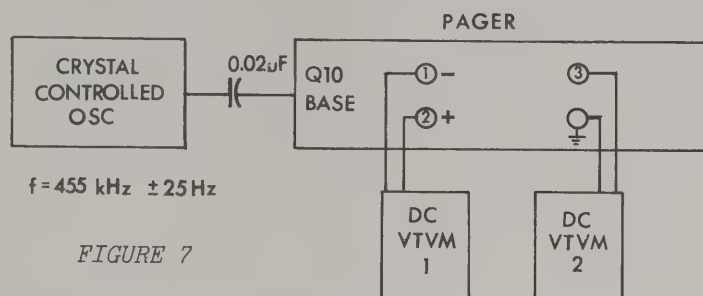


FIGURE 7

Input (Q10 base) 455 kHz SG, unmodulated

Output (1) (DC VTVM) Connected between test points 1 and 2

Output (2) (DC VTVM) Connected between test point 3 and ground

Using the crystal controlled oscillator, adjust the discriminator primary (pink core) for maximum output (between test points 1 and 2). Then adjust the discriminator secondary (blue core) for zero meter indication (between point 3 and ground).

455 kHz IF STAGE (T7) ADJUSTMENT

Since a ceramic filter is employed in the IF circuit, a slow-speed frequency sweeper (approximately 10 cycles) should be used as the signal generator to measure the filter characteristics.

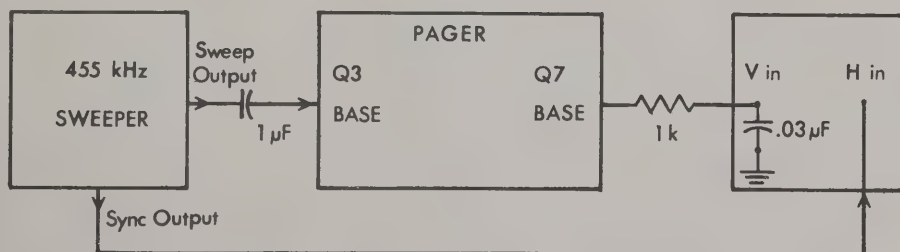


FIGURE 8

- (a) Connect the sweep output to base of transistor Q3 as shown in Figure 8.
 - (b) Connect the vertical input of the scope to the base of Q7 as shown in Figure 8.
- Adjust transformer T7 so that the output waveform shown in Figure 9 is obtained.

NOTE
The ripple in bandpass curve
should not exceed 3 db, p-p.



FIGURE 9

LOCAL OSCILLATOR ADJUSTMENT (CT2)

The local oscillator frequency must be accurately adjusted.

Connect the equipment as shown in Figure 10 and adjust CT2 so that the frequency counter will indicate the crystal fundamental frequency (f_c minus $455 \text{ kHz} \div 9$).

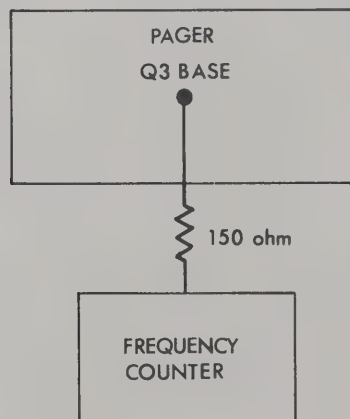


FIGURE 10

1ST STAGE ADJUSTMENT (T4, T5, T6)

Set the signal generator frequency to the 1st IF frequency (operating frequency minus $8 \times$ crystal frequency) and precisely adjust the cores in transformers T4, T5, and T6. Reduce the signal generator output as the gain and sensitivity increases. Then tune the cores for maximum sensitivity, making sure that the signal generator level is well below saturation.

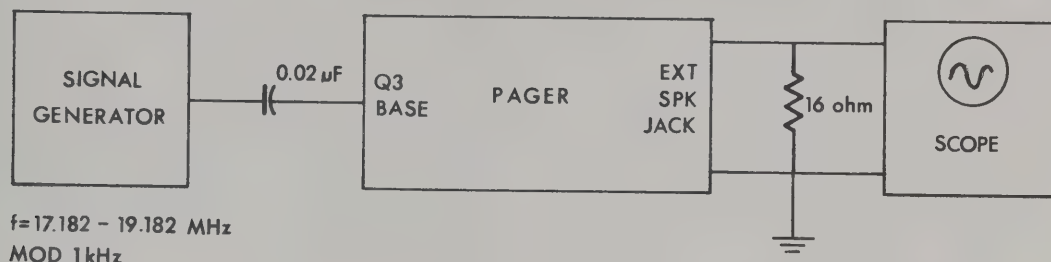


FIGURE 11

OVER-ALL ADJUSTMENT (CT1, T2, T3, T4, T5, T6, T8, & T9)

- (a) Connect the equipment as shown in Figure 12 and set the Signal Generator frequency to f_c (the operating frequency of the pager). Accurately adjust transformers (CT1, T2, T3, T6 and T9). Decrease the Signal Generator output to an extremely low level (lower than $1 \mu\text{V}$) so that the set noise accompanied by the modulated signal generator tone is audible, thereby obtaining the highest sensitivity. Confirm that the final sensitivity is better than $0.5 \mu\text{V}$ for 20 DB quieting. Remove the Signal Generator output cable from the EXT ANT JACK, and receive the signal with the internal loop antenna. Repeat CT1 for optimum performance.

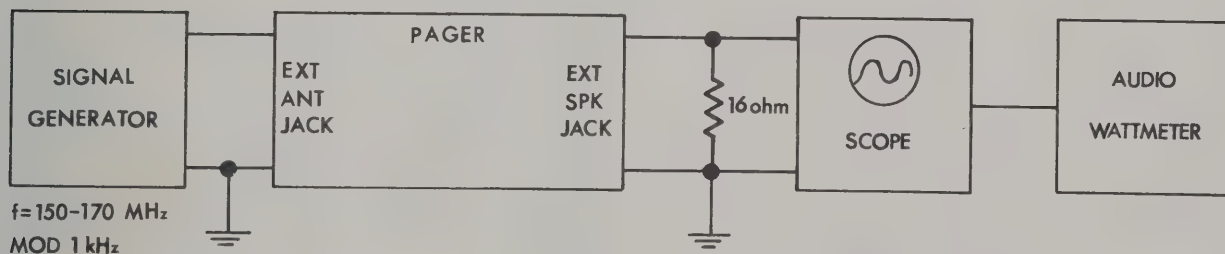


FIGURE 12

- (b) Connect test equipment as shown in Figure 13. Install reeds (of corresponding frequencies with decoder reeds A and B) in encoder. Set the signal generator to the operating frequency and modulate the generator with the encoder. Adjust the encoder output to obtain 3 kHz deviation. Depress the reset button on the pager. Transmit a modulated signal from generator into pager. The call tone should be heard indicating the receiver is ready to receive another message. Disconnect the encoder and modulate the signal generator with a 1 kHz tone. Confirm that the 1 kHz tone is heard for at least 3 minutes. Repeat the above check with the lamp-tone switch in the lamp position and confirm that the lamp operates on call. The lamp should light momentarily.

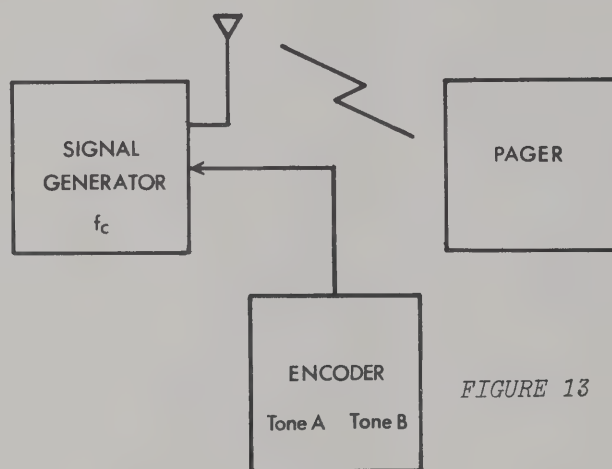


FIGURE 13

The audio signal must terminate immediately after the RESET switch is depressed. Then a signal tone or noise should not be heard unless the signal which conforms to the time diagram in Figure 14 is transmitted.

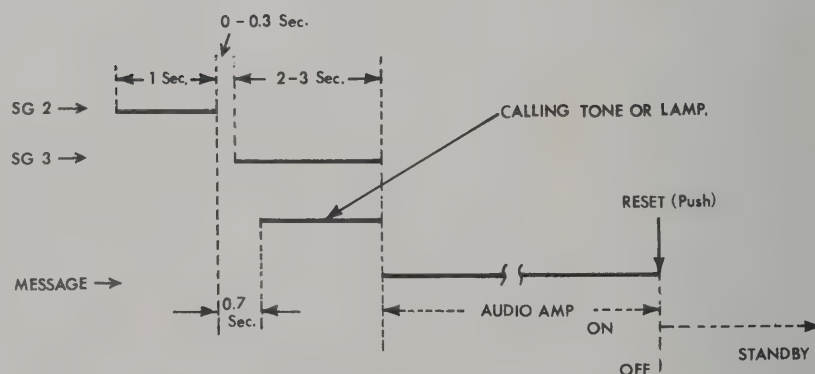
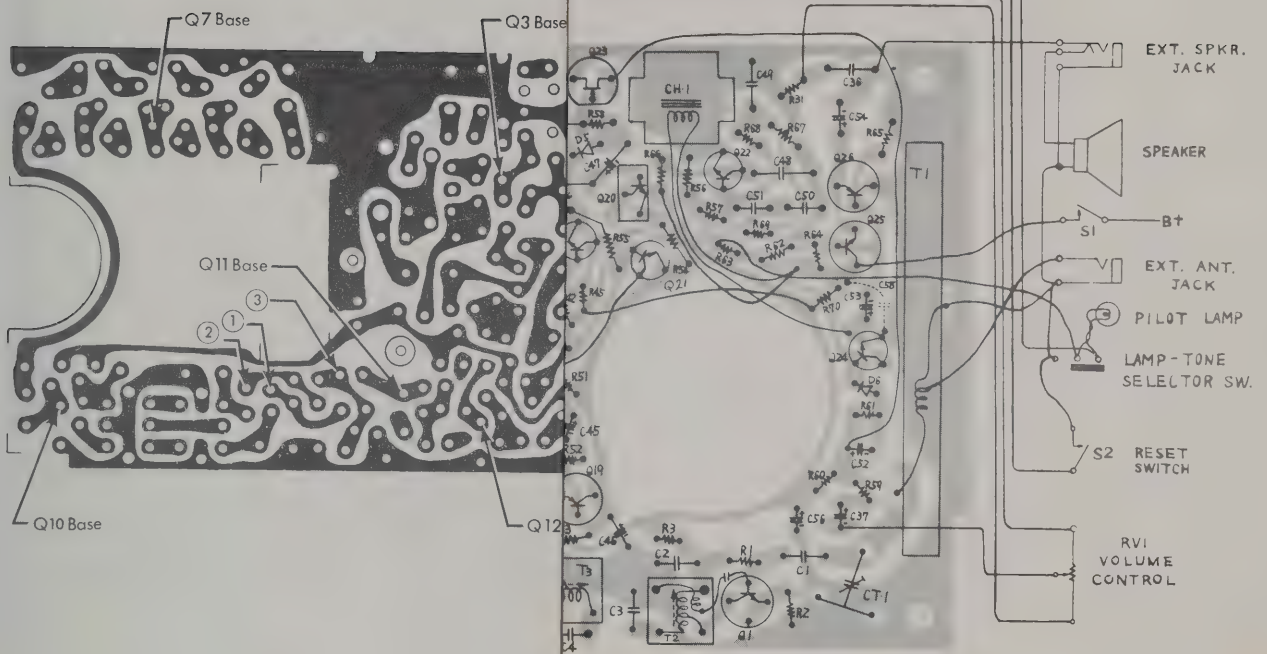


FIGURE 14

- (c) Check the VOLUME control to see that it is operating smoothly, and if the switches are mounted securely. Also check the external appearance of the equipment for flaws or dirt.



PRINTED CIRCUIT BOARD COMPONENT LAYOUT

- (b) Connect test equipment as shown in Figure 13. Install reeds (of corresponding frequencies with decoder reeds A and B) in encoder. Set the signal generator to the operating frequency and modulate the generator with the encoder. Adjust the encoder output to obtain 3 kHz deviation. Depress the reset button on the pager. Transmit a modulated signal from generator into pager. The call tone should be heard indicating the receiver is ready to receive another message. Disconnect the encoder and modulate the signal generator with a 1 kHz tone. Confirm that the 1 kHz tone is heard for at least 3 minutes. Repeat the above check with the lamp-tone switch in the lamp position and confirm that the lamp operates on call. The lamp should light momentarily.

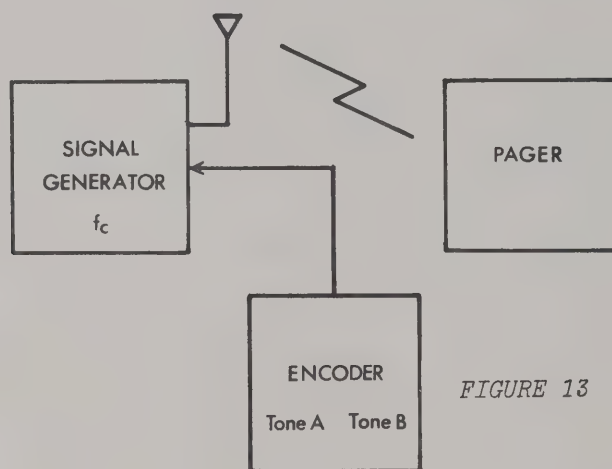


FIGURE 13

The audio signal must terminate immediately after the RESET switch is depressed. Then a signal tone or noise should not be heard unless the signal which conforms to the time diagram in Figure 14 is transmitted.

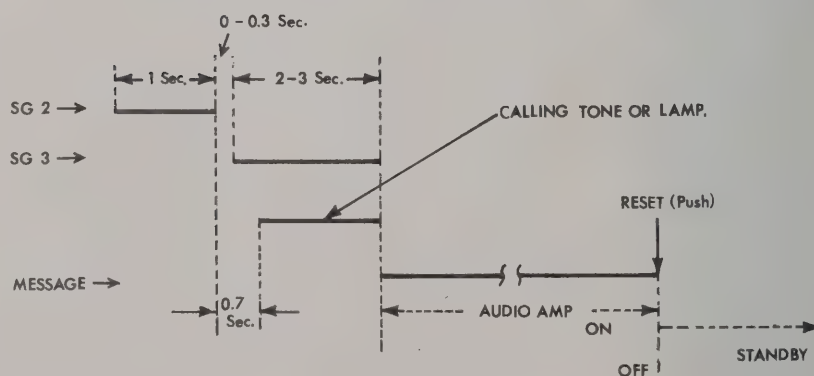
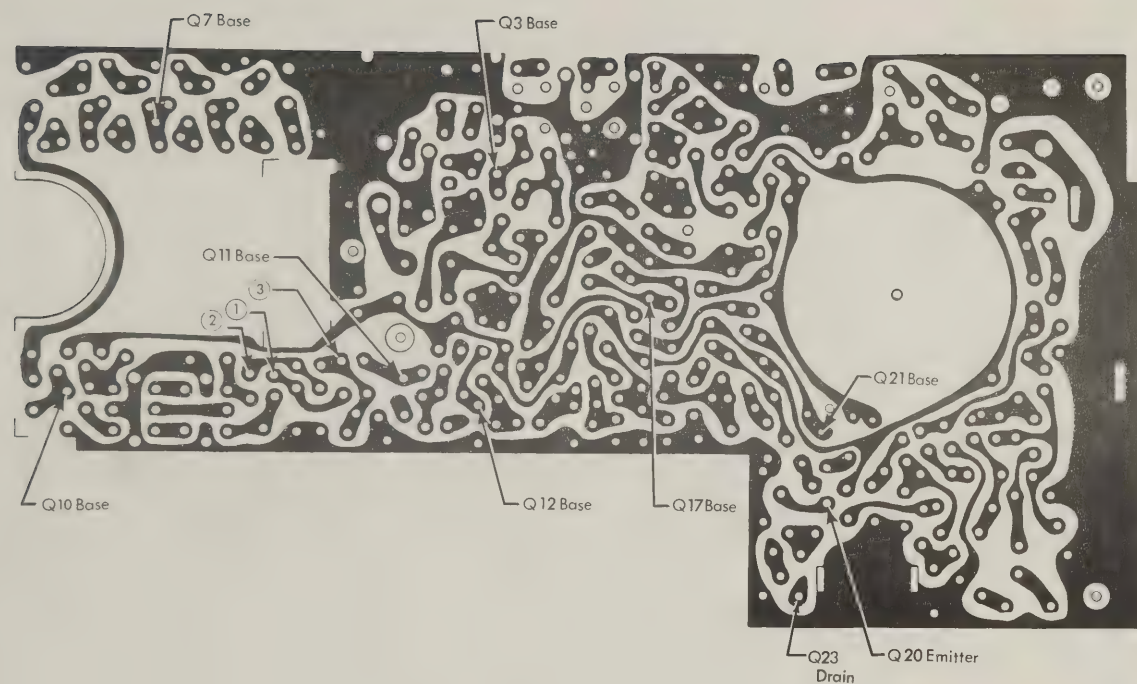
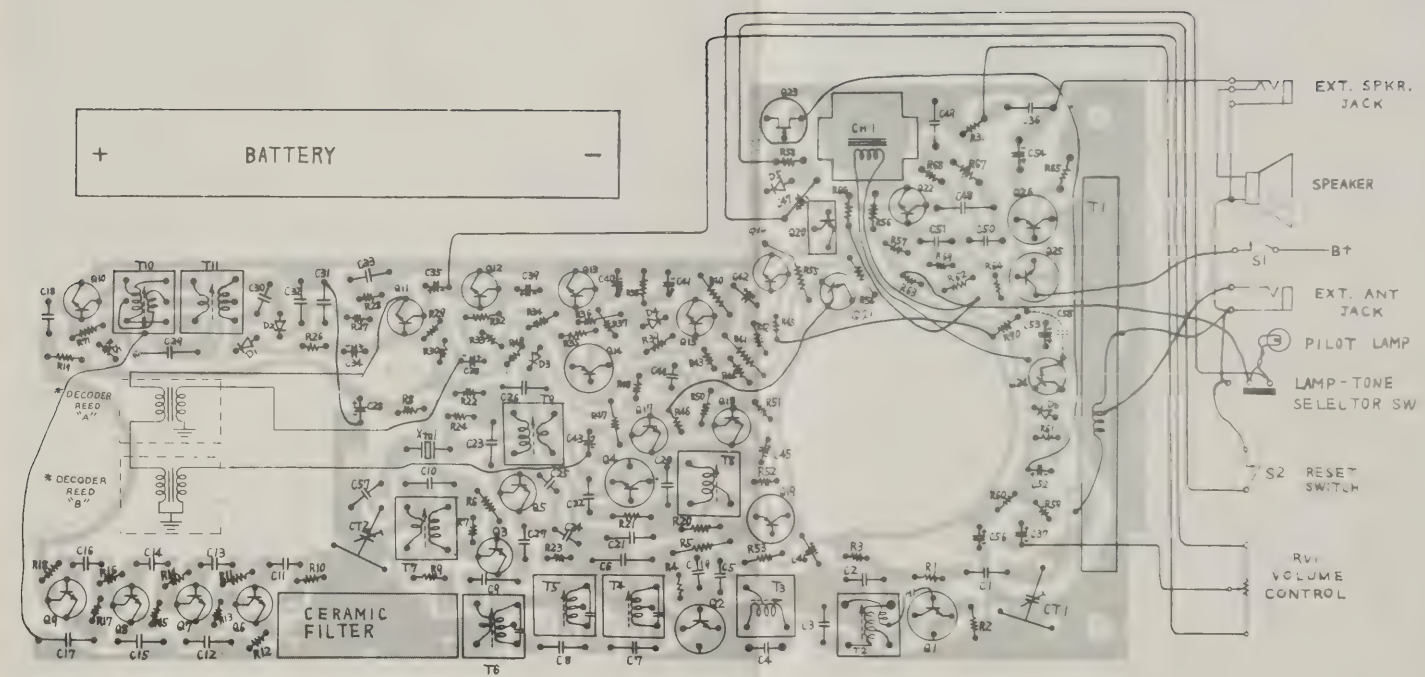


FIGURE 14

- (c) Check the VOLUME control to see that it is operating smoothly, and if the switches are mounted securely. Also check the external appearance of the equipment for flaws or dirt.

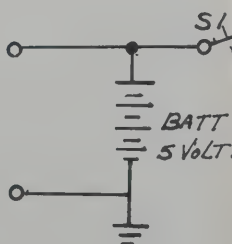
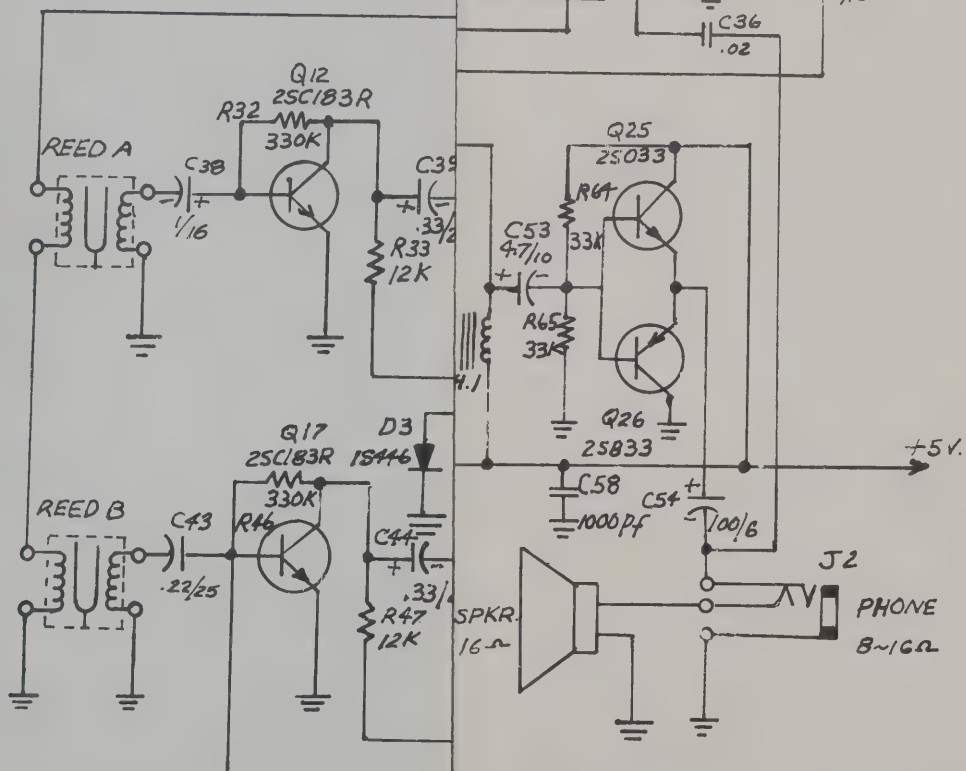
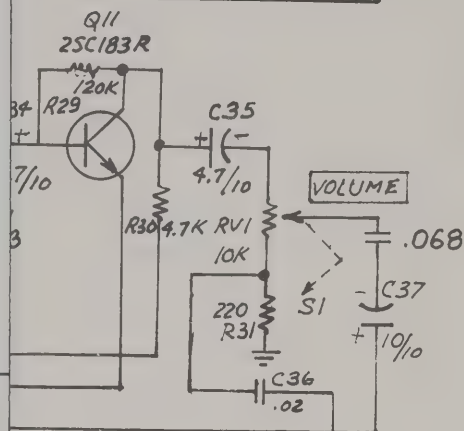
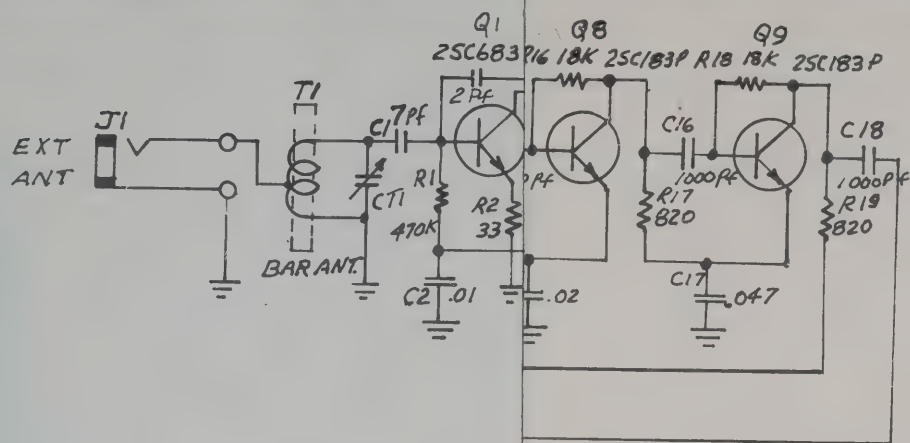


PRINTED CIRCUIT BOARD - TEST POINT DIAGRAM

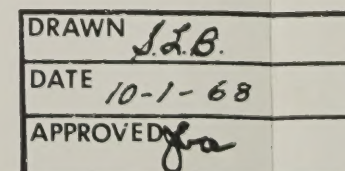


*NOTE: Decoder reed "A" is the first call tone
Decoder reed "B" is the second call tone

PRINTED CIRCUIT BOARD - COMPONENT LAYOUT




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